

SECTION 16—SIGNATURE CONTROL TECHNOLOGY

OVERVIEW

This section covers signature control technologies which are key to existing and anticipated weapons suites for military land, sea and air forces. Topics include critical aspects of radar, infrared, visible, laser, magnetic and acoustic signatures. Selected segments of space and underwater detection and concealment are also not included. In all portions of the energy spectrum, the application of signature control begins with accurate measurements of the signature of the weapons system, embedded systems, subsystems, components, subcomponents and materials which, in sum, comprise the total signature. The desired final signature becomes a target signature and drives a total signature budget during research, acquisition and operations. Sophisticated test equipment, procedures and techniques were developed, designed and applied to meet development and operational requirements. These, coupled with final tailoring of vehicles and systems, required years of research and investment. Each case of signature control is a unique summation for specific weapon or system. While technologies are treated individually, this section does not have subsections, indicating the extraordinary importance of integration of many factors into a single operating entity. Techniques play an immensely strong role in all phases of signature control. See also Section 12.2.

Table 16.0-1. Signature Control Technology Militarily Critical Technology Parameters

TECHNOLOGY	Militarily Critical Parameters Minimum Level to Assure US Superiority	Critical Materials	Unique Test, Production, and Inspection Equipment	Unique Software and Parameters	Control Regimes
RF SIGNATURE CONTROL TECHNIQUES	Signature reduction at normal incidence >: 5 dB for bandwidth 15% of center frequency for 1 MHz - 2 GHz 15 dB for bandwidth > 15% of center frequency for 2 GHz - 18 GHz 5 dB for bandwidth > 5 % of center frequency for 18 GHz - 1000 GHz	Graded resistive films, durable or high wear area RAM, loaded foams, loaded cores and fibers, loaded planar or variable graded absorbers, magnetic loaded materials, particles, whiskers, or ceramics	Specialized test and inspection, equipment and procedures that will characterize military system signatures. Low clutter RCS ranges	"Active control software" and source code. Dedicated source code. All object code which enables you to arrive at militarily critical parameters	WA IL Cat 1 MTCR 17
DESIGN TECHNIQUES SUPPORTING LOW- OBSERVABLE PERFORMANCE OF EXTERNALLY MOUNTED AVIONICS ELEMENTS INCLUDING: <ul style="list-style-type: none"> • RADOMES • ANTENNAS • WINDOWS • SPECIAL ECM ELEMENTS 	Signature reduction at normal incidence 5 dB for bandwidth 15% of center frequency for 1 MHz - 2 GHz 15 dB for bandwidth > 15% of center frequency for 2 GHz - 18 GHz 5 dB for bandwidth > 5 % of center frequency for 18 GHz - 1000 GHz	Graded resistive films, durable or high wear area RAM, loaded foams, loaded cores and fibers, loaded planar or variable graded absorbers, magnetic loaded materials, particles, whiskers, or ceramics	Specialized test and inspection, equipment and procedures that will characterize military system signatures. Low clutter RCS ranges	"Active control software" and source code. Dedicated source code. All object code which enables you to arrive at militarily critical parameters	None

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Table 16.0-1. Signature Control Technology Militarily Critical Technology Parameters (Continued)

TECHNOLOGY	Militarily Critical Parameters Minimum Level to Assure US Superiority	Critical Materials	Unique Test, Production, and Inspection Equipment	Unique Software and Parameters	Control Regimes
ABSORBER MATERIALS FOR RF ENERGY	Frequencies $> 2 \times 10^7$ and $< 3 \times 10^{12}$ Hz includes hair (natural and synthetic with no magnetic loss); Planar (non metallic, absorption > 12 dB, temperature > 79 °C); Ceramic , absorption > 10 dB, temperature > 700 °C; Sintered Ferrite with SpG > 4.4 , operating temperature > 275 °C; graded resistive film which functions at 523 °C or more.	Graded resistive films, durable or high wear area RAM, loaded foams, loaded cores and fibers, loaded planar or variable graded absorbers, magnetic loaded materials, particles, whiskers, or ceramics	Production line metrology is key to assure consistency of end product vital to retaining signature traits	Dedicated signal processing software source code; has multiple applications in this area to reveal actual militarily critical system parameters	WA IL Cat 1 MTCR 17
SYSTEMS FOR USE ON ANY SURFACE OR SUBSURFACE VESSEL: PASSIVE MOUNTS FOR ACOUSTIC ISOLATION AND OTHER COMPONENTS FOR SOUND OR VIBRATION ISOLATION BY ACOUSTIC MOUNTS	Frequency 10 Hz–100 MHz; Isolation cancellation/shifting of performance > 6 dB and attenuation < 500 Hz	Specially designed materials, coatings, paints for acoustic signature reduction at frequencies < 500 Hz	Noise measurement systems for total vessels or components thereof	Dedicated signal processing software source code; has multiple applications in this area	WA IL Cat 8 WA ML Cat 9
ACOUSTIC SIGNATURE: ACTIVE NOISE REDUCTION OR CANCELLATION SYSTEMS, OR MAGNETIC BEARINGS AND ELECTRONIC CONTROLS FOR SUCH SYSTEMS	Noise reduction > 6 dB for systems with > 1 degree of freedom	None identified	Noise measurement systems for total vessels or components thereof	"Active control software" and source code	WA IL Cat 8 WA ML Cat 9
ACOUSTIC SIGNATURE: AIP SYSTEMS: BRAYTON, STIRLING, OR RANKINE CYCLE ENGINES, DIESEL CYCLE ENGINES; AND FUEL CELLS WITH OUTPUT POWER > 2 kW: DEVICES OR ENCLOSURES ESPECIALLY DESIGNED FOR UNDERWATER NOISE REDUCTION	Frequency 10 kHz to 100 kHz Noise reduction > 6 dB	None identified	Vessel and system noise measurement suites. Capabilities are classified.	None identified	WA IL Cat 8 WA ML 9

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Table 16.0-1. Signature Control Technology Militarily Critical Technology Parameters (Continued)

TECHNOLOGY	Militarily Critical Parameters Minimum Level to Assure US Superiority	Critical Materials	Unique Test, Production, and Inspection Equipment	Unique Software and Parameters	Control Regimes
ACOUSTIC SIGNATURE: MATERIALS COATINGS, AND PAINTS FOR ACOUSTIC SIGNATURE CONTROL	Attenuation > 6 dB	Anechoic; Specially designed materials, coatings, paints, for acoustic signature reduction at frequencies < 500 Hz	Vessel and system noise measurement suites. Materials characterization measurement systems. Capabilities are classified	None identified	WA IL Cat 8 WA ML 9
MODELS TO PREDICT ACOUSTIC SIGNATURES OF A SURFACE OR SUBSURFACE VESSEL IN ANY OCEAN ENVIRONMENT	Any capability to predict real world change of any magnitude to theoretical models or algorithms; Empirical validation causing any (nonzero) changes to model algorithms based solely on theory	None identified	None identified	Software specially designed for analyzing or predicting signatures	WA ML 9
IR SIGNATURE CONTROL TECHNIQUES	Any IR signature reduction within wavelength 0.7 μm –20 μm	Materials reflectivity with (compatible wavelength) Temperature > 177 °C	Test equipment to validate and explore IR signature characteristics of integrated systems and platforms	Computer codes for dedicated signal processing software source code; Has multiple applications in this area	WA IL Cat 1 MTCR 1, 17
VISUAL SIGNATURE CONTROL TECHNIQUES	For 0.4 μm –0.7 μm visual contrast of < \pm 15% with 90% solar glint reduction	None identified	None identified	Dedicated optical signal processing code edge detection and color composition	WA ML 17
LASER SIGNATURE CONTROL TECHNIQUES	Reflectivity < 5% for wavelength 0.3 μm –10.6 μm on material illuminated by a laser	Coatings and optical goods for reducing laser reflection	None identified	Computer source codes used to predict laser signature	WA IL Cat 1 MTCR 17
MAGNETICS SIGNATURE CONTROL TECHNIQUES	> 50% reduction in magnetic signature	Specially designed materials, coatings and/or paints to reduce magnetic signature	Confirmation of degaussing and deperming effectiveness	Computer software source code used to predict countermeasure effectiveness or sensor performance	WA ML 17
MULTISPECTRAL SIGNATURE CONTROL TECHNIQUES	Any combination of two or more of the above transparency categories which reduce signature 50% or more of the parameters in each specified category.	Coatings, surface treatments, optical materials + RF transparency and materials as characterized above	Confirmation of multi-spectral detection and identification	Computer software source code used to predict countermeasure effectiveness or sensor performance	WA IL Cat 1 MTCR 17